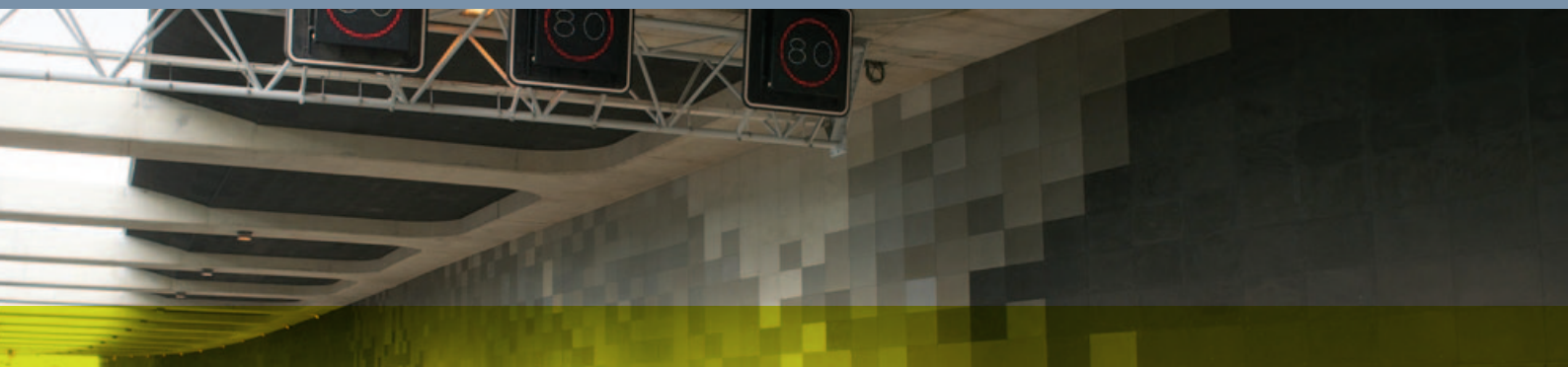


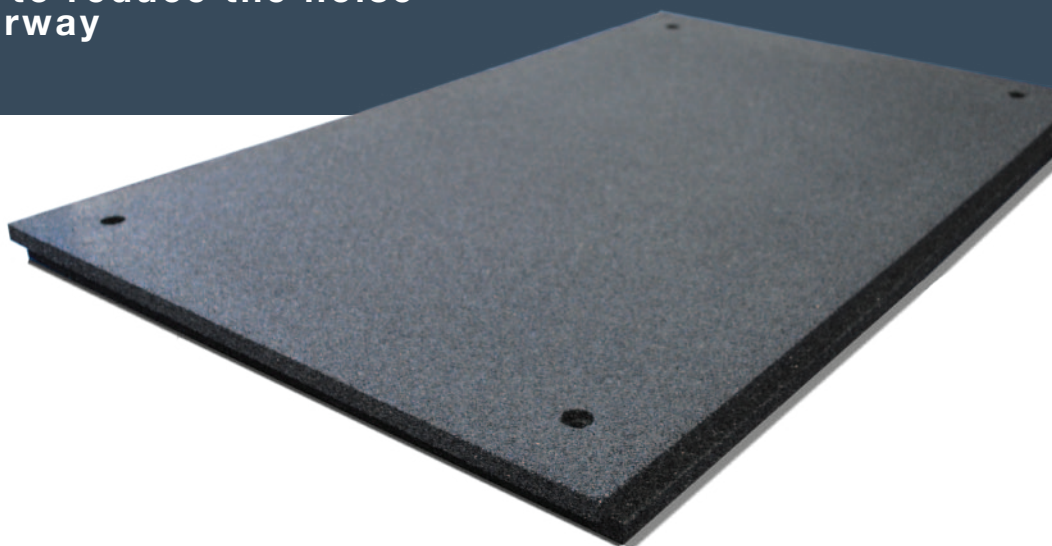
Innovative Acoustics



Project:
A4 Burgerveen - Leiden Road Tunnel, Holland
Quietstone FR30 system



**An innovative project to reduce the noise
impact of a new motorway**



One side of the new tunnel, before installation of Quietstone panels.



CLIENT:	BAM RUBEDEL
PARTNERS:	VAN CAMPEN ALUMINIUM
STARTED:	2011
COMPLETION:	2013
QUANTITY:	47,000m ²

A4 Burgerveen - Leiden Road Tunnel, Holland

The A4 motorway is an important road between Amsterdam and The Hague. Due to congestion, the motorway is being widened from 2 lanes. This resulted in extensive planning on minimising the environmental impact from the development, one of the main concerns being the impact the new traffic will have on noise levels for local residents. It was decided that the road would be recessed into the ground with a partially open ceiling. While this obscures the direct sound path between the source (road traffic) and receivers (local houses), if left untreated, the reverberant sound field would leave complex reflective paths for the sound.

This could be particularly troublesome in the low frequencies, where sound is diffracted the most around the edges of the ceiling, exposing residents to unacceptable noise levels.

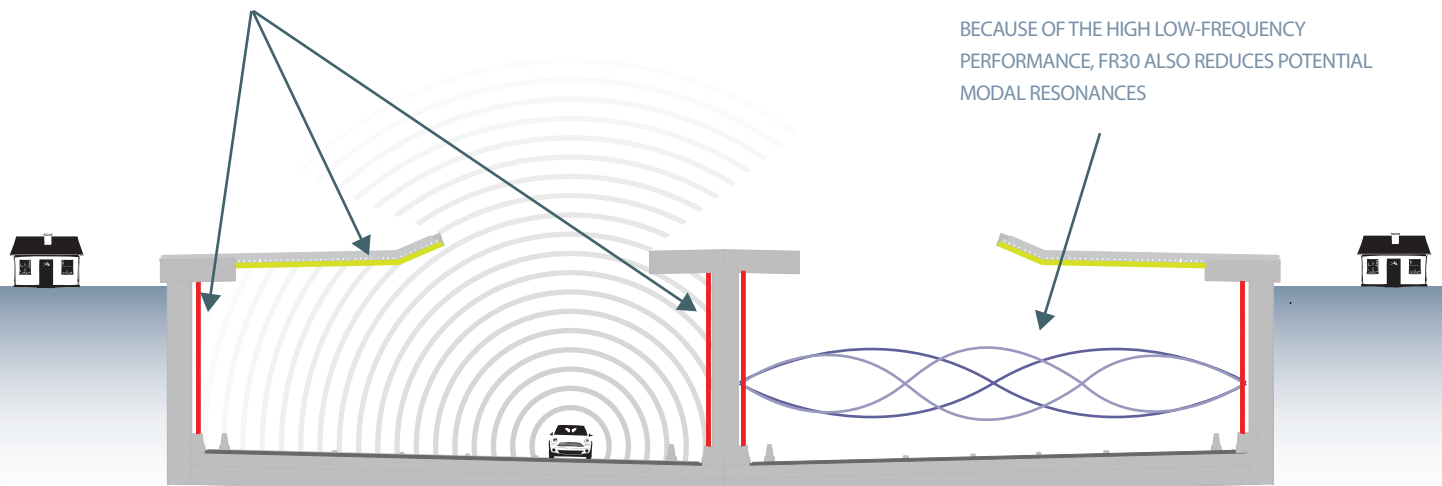
After extensive development, Quietstone, along with our partners in fixing engineering and metal work; Van Campen Aluminium, were awarded the contract to line the tunnel with acoustically absorbent panels on a bespoke mounting framework. One panel for the wall, and a lighter version for the ceiling.

The system provides high broadband sound absorption, with high fire safety, stone-like durability and a range of colours to add an aesthetic bonus to the installation.

QUIETSTONE PANELS CUT DOWN REVERBERATION. THIS GREATLY IMPROVES THE EFFICIENCY OF THE TUNNEL SHAPE, REDUCING THE NOISE FROM THE OPEN TOP TO PROTECT LOCAL RESIDENTS

BECAUSE OF THE HIGH LOW-FREQUENCY PERFORMANCE, FR30 ALSO REDUCES POTENTIAL MODAL RESONANCES

- QUIETSTONE FR30 APPLIED
- QUIETSTONE FR30L APPLIED (a lighter, ceiling mounted panel)



Mounting

The fixing for the wall mounted panels includes vertical steel C-sections with bespoke brackets to quickly fix the panels to. These sections also include supports for mineral fibre slabs which add the the acoustic performance.

Panels are mechanically fixed, with plugs of the same material used to fill the fixing points.

The ceiling utilises a very similar system, only the mineral fibre is sinned against the concrete, and the panels have more fixing points.



“Noise pollution is one of the most prevalent sources of environmental complaint in the European Union.”

- Rok Ho Kim - Occupational health scientist at the World Health Organisation (WHO) Regional Office for Europe



Technical information

Physical properties

Standard size: 1000 x 600 x 30mm

(other sizes used to fit around services)

Weight: FR30 - 37.5kg/m²

FR30L - 22.5kg/m²

Fire resistance

Tested by Efectis Nederland BV for tunnel fire safety.

The test involves exposure of a full wall construction to 1150°C for 2 hours and panels must not disintegrate or exceed °C in the rear cavity

Impact resistance

EN 1794-1 'Road traffic noise reducing devices - non acoustic performance - impact of stone': "Elements appear to show no visual damage."

Freeze / thaw resistance

EN 1338 - Class 0

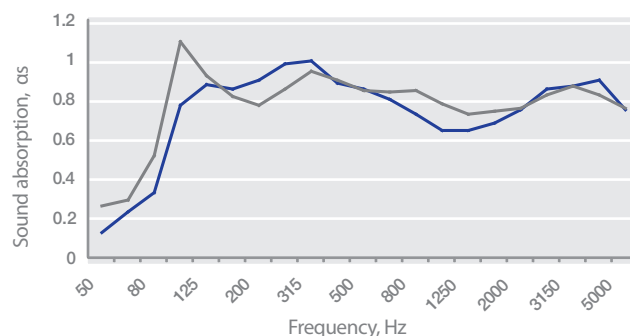
Acoustic performance

Tested in accordance with BS EN ISO 354: 2003 at TNO, Holland.

Mounting parameters:

Test 1 - 190mm total buildup;
30mm panel, 90mm air gap,
70mm Rockwool.

Test 2 - 190mm total buildup;
30mm panel, 30mm Rockwool,
60mm air gap, 70mm Rockwool.



	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	EN-ISO 11654 α _w	EN 1793-1 DL α	DL α, rail
Test 1	0,85	1,00	0,85	0,70	0,80	0,85	0,80 (L); class B	7dB(A); cat A2	7dB(A)
Test 2	0,95	0,90	0,90	0,80	0,80	0,85	0,85 (L); class B	8dB(A); cat A3	8dB(A)

“Not only is noise pollution an annoyance, but it can also be a significant short and long-term health hazard.”

- Rok Ho Kim, Occupational health scientist at the World Health Organisation (WHO) Regional Office for Europe

The setting

As you can see from the picture to the right, the motorway cuts through a fairly built-up area. Notoriously flat in plane, Holland has a large demand for noise barriers as it can be difficult to position new roads in areas where the surroundings will provide natural noise reduction.

In this case the road was initially recessed down to break the direct sound path to the residents without the need to use large barriers which can obstruct views.

Unlike light however, sound energy can bend around objects so by reducing noise build up, our panels make the design much more efficient.



Manufacture

A project of this scale and importance has required the ability to produce rapidly, and with scrupulous quality control. This has meant developing a new plant and we now have the infrastructure to cater for projects of almost any scale.



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